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Impact of Soybean Row Spacing on Bean Pod Mottle Virus

Abstract

Bean pod mottle virus (BPMV) remains the most prevalent viral disease of soybean in the U.S., affecting both soybean yield and quality. This plant virus is spread primarily by bean leaf beetles. The objective of this study was to quantify the temporal and spatial spread of BPMV in three different soybean row spacings (7.5 in., 15 in., and 30 in.).

Keywords

RFR A1070, Plant Pathology and Microbiology

Disciplines

Agricultural Science | Agriculture | Plant Pathology

Impact of Soybean Row Spacing on *Bean Pod Mottle Virus*

RFR-A1070

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Introduction

Bean pod mottle virus (BPMV) remains the most prevalent viral disease of soybean in the U.S., affecting both soybean yield and quality. This plant virus is spread primarily by bean leaf beetles. The objective of this study was to quantify the temporal and spatial spread of BPMV in three different soybean row spacings (7.5 in., 15 in., and 30 in.).

Materials and Methods

Soybeans (cultivar NE3001) were planted on April 28, 2010 at the Iowa State University Southeast Research Farm located in Crawfordville, IA. Plots measuring eight rows by 30 ft were established for each of the three row spacing treatments, each of which was replicated three times. The six center rows in each plot were divided into 25 one-ft quadrats. Quadrats were thinned to four soybean plants each. The 13th quadrat in rows 3 and 4 of each soybean plot were inoculated with BPMV. Soybean quadrats were then sampled and tested for the presence of BPMV every 9 to 11 days until crop senescence. Samples consisted of the uppermost trifoliolate from each of the four soybean plants within a quadrat. Bulked four-leaf samples were tested for the presence/absence of BPMV using a serological test (ELISA). Data were analyzed by ANOVA with a Tukey option ($P < 0.05$) for mean separations. Linear regression was used to quantify rates of BPMV temporal spread as affected by row

spacing. Spatial analyses were performed using ordinary runs analysis.

Results and Discussion

Row spacing did not significantly affect the rate of temporal spread of BPMV in 2010 (Figure 1). This is likely the result of low bean leaf beetle populations early in the season. Bean leaf beetles did not appear in plots until July 6, which was well after the rows had already closed in each of the three row spacing treatments.

Regression analysis revealed that the logistic model best explained the relationship for the change in BPMV incidence with respect to time (Figure 1). Coefficients of determination ranged from 93.5 to 97.7 percent, indicating that time (day of year) explained 93.5 to 97.7 percent of variation in BPMV incidence. Using the logistic model, it was determined that the rate of BPMV spread ranged from 0.3 to 0.5 logits/day for the three row spacings. Doubling times (the time for disease incidence to increase from 1 to 2%, 2 to 4%, etc.) ranged from 14 to 23 days in 2010. Doubling times in 2010 were longer than doubling times measured in previous years. For example, in 2006, doubling times in similar experiments ranged from just 5 to 7 days (approximately 2 to 4 times faster than in 2010). The slower spread and longer doubling times of BPMV epidemics in 2010 were likely due to the low population densities and the delayed appearance of bean leaf beetles during the 2010 growing season.

As in previous years, BPMV-infected quadrats were highly clustered throughout the growing season in all treatments, with most spread occurring within the rows as opposed to across rows (Figure 2).

Acknowledgements

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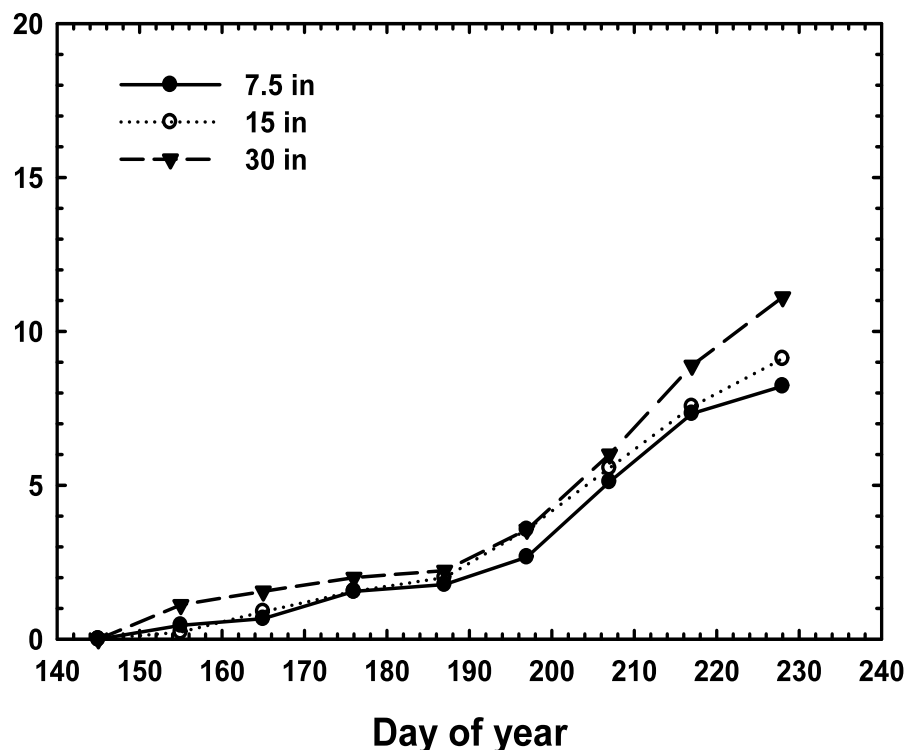


Figure 1. Effect of row spacing on the temporal spread of *Bean pod mottle virus* in soybean (cultivar NE3001) at the ISU Southeast Research Farm, Crawfordsville, IA, in 2010.

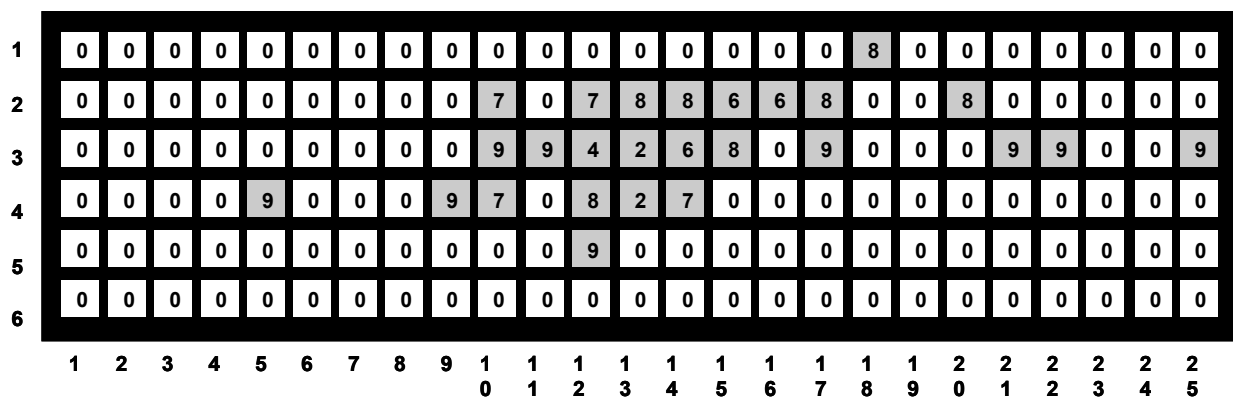


Figure 2. Example of the within-field spread of *Bean pod mottle virus* (BPMV) in soybean (cultivar NE3001) planted at the ISU Southeast Research Farm, Crawfordsville, IA in 2010. Each field plot was 6 rows wide \times 25 quadrats per row = 150 quadrats per plot. Quadrats located in the center two rows in the 13th quadrat position were inoculated with BPMV at the beginning of the growing season. All quadrats were sampled for the presence of BPMV every 9 to 11 days and BPMV positive quadrats were mapped. Each quadrat was 30 cm (1 ft) in length and each quadrat consisted of four soybean plants. Numbers within quadrats indicate the sampling time that BPMV was first detected.